

Laboratory Certification and Audit Procedures for Facilities that Inspect/Test Printed-Wiring Boards (PWBs)

DOCUMENT IDENTIFIER: A-SP-ELMF088-03-0000 Rev B, 04-Dec-1992

ABSTRACT: This specification establishes the procedures and certification requirements for facilities and the personnel involved in inspection and testing printed-wiring boards (PWBs) in accordance with DEC STD 088-0 Qualification Procedures for All Printed-Wiring Boards Suppliers.

APPLICABILITY: The requirements of this document are mandatory for all Digital organizations that perform inspection or destructive testing in accordance with DEC STD 088-0. The requirements are also mandatory for any external facility performing inspection or destructive testing for Digital.

STATUS: APPROVED 04-Dec-1992; use VTX SMC for current status.

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CONTENTS

1 PURPOSE	1
1.1 GOAL	1
1.2 APPLICABILITY	1
1.3 RESPONSIBILITY	1
2 REQUIREMENTS	2
3 MASTER EQUIPMENT LIST REQUIREMENTS	3
4 CALIBRATION EQUIPMENT REQUIREMENTS	6
5 GUIDELINES FOR PERSONNEL	6
5.1 RECOMMENDED GUIDELINES FOR PERSONNEL CAPABILITIES	7
5.2 RECOMMENDED TRAINING FOR PERSONNEL INVOLVED IN INSPECTION OR TESTING OF PWBs	7
6 AUDIT REQUIREMENTS	8
6.1 AUDIT PROCEDURE	8
6.2 CORRECTIVE ACTIONS	9
7 CERTIFICATION	10
Appendix A APPENDIX A SAMPLE AUDIT CHECKLIST	11
Appendix B APPENDIX B SAMPLE CALIBRATION CHECKLIST	13
Appendix C SAMPLE MEASUREMENT CAPABILITY PERFORMANCE	15
C.1 MEASUREMENT CAPABILITY STUDY	15
C.1.1 MEASUREMENT ERROR	15
C.2 GAGE CAPABILITY STUDY	15
C.2.1 Formal Gage Study	15
C.2.2 Quick-Look Gage Study	16
Appendix D REFERENCED DOCUMENTS	19
D.1 Digital Documents, EL-Class	19
D.2 Documents External to Digital	19
GLOSSARY	21

FIGURES

1	Generic Equipment List	3
2	Master Equipment List Form	5
3	Variable Gage Study	16
4	Measurement System/Gage Capability	17

1 PURPOSE

This document establishes the procedures and certification requirements for facilities and personnel involved with inspecting and testing Printed-Wiring Boards (PWBs) in accordance with *DEC STD 088-0 Qualification Procedure for All Printed-Wiring Board Suppliers*.

This specification is intended to provide a standardized method for auditing and evaluating a technically-oriented inspection or test facility, resulting in certification of that facility for performing inspection or testing according to DEC STD 088-0. Any location that performs inspection or destructive testing as part of DEC STD 088-0 shall be considered part of the facility.

1.1 GOAL

The goal of this document is to provide facilities that perform inspection or destructive testing as part of DEC STD 088-0 with a consistent certification procedure. These methods and procedures shall be uniformly applied and administered on a worldwide basis.

1.2 APPLICABILITY

The requirements of this specification are mandatory for all Digital organizations that perform inspection or destructive testing in accordance with DEC STD 088-0. The requirements are also mandatory for any external facility performing inspection or destructive testing for Digital according to DEC STD 088-0.

1.3 RESPONSIBILITY

The following responsibilities are required to participate in the processes leading to the certification of facilities. For definition of these groups, refer to the Glossary at the end of this document.

1. The DEC STD 088-0 Committee shall:
 - Be responsible for the technical content and requirements of this specification. Refer to DEC STD 088-0 for more information.
 - Identify the certifying agency.
2. The Interconnect Center of Expertise (ICOE) Quality Manager shall:
 - Notify the certifying agency of an inspection or test facility applying for certification.
3. The certifying agency shall:
 - Identify a representative to complete an audit of a facility.
 - Review documentation and perform the audit for certification of the inspection or test facility. Refer to subhead 6.1 for Audit Procedures.
 - Make recommendations for certification or noncertification of the facility. Refer to DEC STD 088-0 for committee information.

4. Inspection and test facilities shall:
 - Document procedures in a manner adequate to demonstrate compliance with this specification and the applicable test methods. Refer to EL-MF088-02, *Destructive Testing Procedures and Microsectioning Guidelines for Printed-Wiring Boards (PWBs)*.
 - Notify the certifying agency of any document or personnel changes.
 - Submit applicable information to the certifying agency for review. Refer to subhead 2.1 for more information.
5. Inspection and Test Personnel shall:
 - Perform inspection, testing, measurements, and evaluations on printed-wiring boards (PWBs) for the purpose of qualifying a PWB in accordance with the requirements listed in DEC STD 088-0. Refer to DEC STD 088-0 for guidance.

2 REQUIREMENTS

The following procedural requirements shall be used to certify an inspection or test facility.

1. The inspection or test facility shall notify the ICOE Quality Manager to apply for facility certification.
2. The ICOE Quality Manager shall notify the certifying agency of the certification request.
3. The certifying agency shall:
 - Advise the Facility of the certification process and requirements, as stated within this specification.
 - Verify that the facility has copies of DEC STD 088-0 and associated specifications.
 - Ensure that a nondisclosure agreement is signed with any external facility to be audited.
4. The inspection or test facility, prior to the audit, shall complete, date, and retain the following documentation at the facility.
 - The managerial structure, including the relationship with its organization components and affiliates.
 - A functional description of the inspection or test facility's organizational structure, operational departments, support departments, and services. (Charts or diagrams are acceptable.)
 - A list of the technical services offered as related to the test methods or appropriate standards for which certification is requested.
 - A complete generic listing of inspection and test equipment used to perform the inspection or testing. Refer to Figure 1.
 - A procedural list for storage of specimens and samples.
 - A Master Equipment List. Refer to Head 3 for completion requirements.
 - Equipment calibration records. Refer to Head 4 for completion requirements.
 - Training materials. Refer to Head 5 for guidelines.

- Documentation that substantiates the system has been implemented and effectively maintained.
5. The certifying agency shall:
- Designate part of the agency to perform the audit.
 - Schedule the audit of the inspection or test facility.
 - Audit the inspection or test facility. Refer to subhead 6.1 for Audit Procedures.
 - Review information from the audit, identify if there are any nonconforming items and either:
 - Notify the inspection or test facility of any corrective actions necessary to obtain approval. Refer to subhead 6.1.1 for more information.
 - Notify the inspection or test facility of the Certification Agreement. Refer to Head 7 for more information.

Figure 1: Generic Equipment List

TEST REQUIRED	EQUIPMENT USED
Visual Methods	MP4 Macrocamera Low Power Optical Stereomicroscope
Optical/Dimensions	Metallographic Benchtop Microscope Filar Eyepiece Measuring System
Thermal Stress Test	Oven Solderpot Thermometer Timer

3 MASTER EQUIPMENT LIST REQUIREMENTS

The Master Equipment List is used for the thorough documentation of each piece of equipment used for inspection and testing.

The following procedural requirements shall be followed when preparing a Master Equipment List. The information shall be retained at the facility and made available during the audit. Refer to Figure 2 for the Master Equipment List Form.

Listed are a master equipment list procedure.

1. Complete the top portion on all pages. The original list date block is the date the original list was prepared. The revised page block is for the revision date of the page or document.

2. Use the Capital Asset Number as the identification number to identify each piece of equipment. This number is used for calibration, traceability, and reference.
3. Identify the equipment using the proper generic name for this type of equipment such as metallograph, grinder, polisher, thermometer, and oven.
4. Identify the actual equipment manufacturer; abbreviated names or initials may be used.
5. Identify the type or model. Use the type or model number shown on the equipment name plate or descriptive literature.
6. Identify the serial number shown on the equipment name plate or descriptive literature.
7. Indicate equipment limits, both minimum and maximum, for all equipment ranges.
8. Indicate the frequency of calibration for the equipment as established by MIL-STD-45662A, *Military Standard Calibration Systems Requirements*, the manufacturer, or other acceptable documented method. Refer to subhead 4.1 for more information.
9. Describe the general use of the equipment and its special features or limitations that will affect the ability to perform the applicable inspection or testing.

Figure 2: Master Equipment List Form

MASTER EQUIPMENT LIST

Page ____ of ____

Name of Facility _____

Street _____

City _____ State ____ Zip _____

Original Submittal Date _____

Dates of Revisions _____

Facility Equip. Identification (Capital assets)	Equipment Name	Manufacturer	Type or Model	Serial Number	Equipment Limits (Include multiple ranges)	Accuracy	Calibration Frequency	Equipment Description and Use (Include parameters, devices, controls)

4 CALIBRATION EQUIPMENT REQUIREMENTS

The inspection or test facility shall calibrate each instrument used to condition, inspect, measure, or test a PWB for acceptability, in accordance with DEC STD 088-0.

Each inspection or test facility shall establish and maintain the following calibration equipment procedure requirements.

The Inspection/Test Facility shall:

- Establish a written description of the calibration system, including factors of environmental conditions.
- Establish and maintain a schedule (at least once a year) for the calibration of measuring and testing equipment based upon stability, purpose, and degree of usage of equipment.
- Maintain records of the scheduled calibrated intervals for each piece of equipment, including the following information.
 - Dates of completed calibrations
 - Due dates for calibration
 - Groups performing the calibration
 - Certification of the compliance of the equipment
- Use calibration standards traceable to National Bureau of Standards (NBS), when applicable.

5 GUIDELINES FOR PERSONNEL

The effectiveness of inspection or testing depends upon the capabilities of the personnel who are responsible for and who perform the inspection or testing. This guideline provides recommendations for the training of inspection or test personnel whose specific jobs require appropriate knowledge of the technical principles underlying the inspection or testing performed, witnessed, monitored, or evaluated.

NOTE

It is recognized that these guidelines may not be appropriate for certain facilities' circumstances or applications. In developing training programs, the facility should review the detailed recommendations presented and modify them, as necessary, to meet particular needs.

5.1 RECOMMENDED GUIDELINES FOR PERSONNEL CAPABILITIES

There are four recommended levels of personnel capabilities. These levels may be combined or subdivided by the facility for specific situations where additional levels of skills and responsibilities are deemed required.

1. Trainees should:
 - Work with qualified personnel and not conduct independently any inspection or testing, interpret or evaluate results of an inspection or test, or report test results.
 - Be supervised by all levels of personnel.
2. Level 1 personnel should:
 - Perform required calibrations.
 - Perform specific tests and evaluations for acceptance or rejection determinations.
 - Be supervised by Level 2 or 3 personnel.
3. Level 2 personnel should:
 - Set up and calibrate equipment.
 - Interpret and evaluate test results with respect to applicable codes, standards, and specifications.
 - Assist in training of Level 1 personnel.
 - Prepare written instructions and report the results of tests.
4. Level 3 personnel should:
 - Establish techniques and procedures, and interpret codes, standards, specifications, and procedures.
 - Designate test methods, techniques, and procedures to be used during testing.
 - Be responsible for the inspection or test facility operations.
 - Establish techniques to assist in establishing criteria when needed.

5.2 RECOMMENDED TRAINING FOR PERSONNEL INVOLVED IN INSPECTION OR TESTING OF PWBs

Personnel who inspect or test PWBs in accordance with DEC STD 088-0 should be trained in the following tests and methods. Refer to the Glossary for definitions of tests and methods and to EL-MF088-02 for testing procedures. Refer to subhead 5.2.1 for a sample training course for the following test procedures.

Visual Test Methods (VTM)
Microsectioning
Dimensional test methods
Thermal stress test
Electrical test methods (such as impedance)
DEC STD 176 Training Session

The training program should include the training course outline for each specified test method to be employed by the inspection or testing facility.

The training course outline should include a description of the following:

- Product construction or manufacturing methods
- Basic test method principles
- Function and operation of the inspection or test equipment
- Procedure for performing each test method
- Evaluation of the inspection or test results
- Review of the specifications in use

The training course outline should indicate the level or degree of training provided to each inspection or test level.

6 AUDIT REQUIREMENTS

The following information establishes the minimum requirements to be used by a certifying agency representative to perform an audit of the inspection or test facility for certification purposes. The intent of the audit is to ensure compliance to applicable specification requirements. Refer to Appendix C for an example of an audit.

6.1 AUDIT PROCEDURE

1. The certifying agency representative shall:

- Review all documentation at the inspection or test facility such as:
 - Chart of the organization
 - List of technical services
 - Copies of test methods
 - Examples of storage facilities
 - Changes or updates to documentation
- Review the established training program.
- Review calibration procedures and records.
- Review procedures available for inspection or testing performed.
- Review data from destructive testing performed including detailed reports of findings.
- Initiate Internal Correlation Testing (Round-Robin Testing).
- Examine the equipment for the following:
 - Traceable identification number
 - Maintenance records
 - Calibration stickers
 - Range applicable for test results
 - Accuracy appropriate for test
 - Applicable safety equipment in place
- Observe specimen identification process to ensure traceability of inspection or test results to inspection or test personnel.
- Examine packaging that provides protection for shipping specimens.

- Observe operational procedures.
 - Review results of inspection or test reports and round-robin test results.
2. The certifying agency shall review audit results and make a recommendation on certification status.
 3. The ICOE Quality Manager shall issue an official letter within 30 days after completion of the audit, containing the following information.
 - Approval—Certification Issued
 - Approval with recommendations—Certification Issued
 - Nonapproval with a list of corrective actions. Refer to subhead 6.1.1 for procedure.

6.2 CORRECTIVE ACTIONS

If the inspection or test facility fails to pass the Certification Audit, the following procedure shall be followed.

1. The certifying agency shall:
 - Identify, in writing, the appropriate corrective action(s) necessary to address the nonconforming items.
 - Propose to the inspection or test facility the appropriate corrective action(s) that should be instituted.
 - Recommend that the certification application be voided after 30 days if the inspection or test facility has not responded.
2. The inspection or test facility shall inform the certifying agency in writing within 30 days after the failure notification, the intent and description of the proposed corrective actions.
3. The certifying agency shall review the response from the inspection or test facility and inform the facility if the proposed corrective actions are acceptable and if a new audit is deemed necessary.
4. Once corrective actions are agreed upon, the inspection or test facility shall implement the corrective actions within a period acceptable to the certifying agency.

7 CERTIFICATION

The certification of the inspection or test facility shall extend only to the specific facility audited and the listed personnel within that facility.

Listed are retention of certifications.

1. The inspection or test facility shall notify the certifying agency within 30 days after implementation when any significant changes to the documentation such as a change in personnel have occurred. Refer to subhead 2.1.3 for documentation required by the inspection or test facility.
2. The certifying agency shall:
 - Ensure the facility demonstrates conformance with this specification by re-auditing on a yearly basis, at a minimum.
 - Schedule the level of reaudit necessary.
 - Audit the inspection or test facility.
3. If an inspection or test facility certification retention audit is overdue by more than 30 days, the certifying agency will communicate to the inspection or test facility manager the delinquency.
 - The inspection or test facility manager will be given 30 days to schedule the retention audit.
 - The certifying agency will send a second reminder to the inspection or test facility manager if 60 days has gone by and a retention audit has not been performed.
 - If the retention audit exceeds 90 days, then the certifying agency will revoke the certification of that facility immediately.

APPENDIX A APPENDIX A SAMPLE AUDIT CHECKLIST

Requirements	A	A/R	N/A	Comments/Recommendations
a. Documentation (1) Chart of organization, structure, affiliation, and so on (2) List of relevant technical services (3) List of test method equipment (4) Copies of relevant specifications, standards, and test methods (5) Documentation of storage facilities (6) Changes updated in documentation				
b. Training/qualification (1) Training program established (2) Training records maintained (3) Eye tests of inspectors available				
c. Calibration (1) System complies with ML-STD-45662 (see Appendix C)				
d. Procedures and Controls (1) Written procedures available for all inspection/tests performed (2) Inspection/test personnel follow written procedures (3) Procedure for recording inspection test, and document controls (4) Records contain all steps of inspection/test procedures (5) Inspection/test results adequately completed and traceable to inspection/test personnel (6) Time in and out specified when required by procedures (7) Data entries readable and initialed where changed (8) Environmental controls adequate to comply with applicable requirements				
e. Equipment (1) Identified with traceable I.D. (2) Adequately maintained (3) Current calibration stickers, and so on (4) Capable of performing test method (5) Range applicable for test results (6) Accuracy appropriate for test (7) Applicable safety equipment in place				
f. Traceability (1) Specimen identification adequate to assure traceability during tests (2) Reports traceable to specimens and customer or project (3) Adequate procedures to assure traceability of inspection/test results to inspection/test personnel				
g. Handling (1) Procedures established to provide adequate protection for specimens throughout inspection/testing (2) Appropriate packaging to provide protection for shipping specimens				
h. Controlled Storage (1) Adequate procedures to provide the proper storage conditions for the specimens throughout processing (2) Adequate storage for specimens on hold prior to or during processing				
i. Test Reports (1) Formats comply with applicable specification requirements (2) Contain all applicable data, procedures, results (3) Retained for three years				
j. Safety Procedures (1) Operating procedures comply with OCEA/OSHA requirements				
k. Other Items _____ _____ _____				

APPENDIX B APPENDIX B SAMPLE CALIBRATION CHECKLIST

Element	List company document title, number, revision.
a. Description of calibration system: (1) Controls for segregation of obsolete damaged or otherwise inaccurate equipment (2) Controls for verification of production tooling (jigs, fixtures) when used (3) List of Measurement Standards (both reference and transfer) (4) Availability of system description, procedures, and calibration reports	
b. Adequacy of calibration standards: (1) Accuracy and resolution (2) Range (3) Stability	
c. Environmental controls: (1) Environmental conditions controls to the extent necessary to assure continued measurements of the required accuracy. Consideration to be given to: Temperature Humidity vibration Other factors (2) Controls for application of compensating corrections to calibration results obtained in nonstandard environments.	
d. Calibration intervals: (1) Establish periodic intervals for the calibration of measuring test equipment and measurement standard. (2) Establish interval period based upon stability, purpose, and degree of usage. (3) Adjustment of interval periods using results of previous calibrations.	
e. Calibration procedures: (1) Establish written procedures for the calibration of measuring test equipment and measurement standards. (2) Requirement for calibration to be performed with higher accuracy level standards. (3) Utilization of published standard practice or manufacturer's instructions. (4) Surveillance or verification that the procedures are being followed. (5) Availability of procedures to the calibration personnel.	
f. Out of tolerance evaluators: (1) Adequacy of Calibration System Procedures to identify and prevent use of unsatisfactory, inaccurate equipment. Review adequacy of test equipment and adjustment of calibration frequency. Review adjust calibration procedure (2) Notification – out of Tolerance Procedures to determine impact of tolerance equipment on product quality. Corrective action procedure for out of tolerance equipment. Procedure to notify customer of possible nonconforming products. Records maintained of results of analysis and corrective action.	
g. Calibration sources: (1) Use of calibration sources whose standards are traceable to N.B.S. (2) Assurance that calibration sources are capable of calibration services to N.B.S. (3) Reference standards are calibrated by a capable facility, lab or the N.B.S. (4) Has report, certificate or data sheet attesting to calibration data, accuracy, and conditions for all reference standards used. (5) Has report, certificate or data sheets attesting to calibration data for equipment.	
h. Application and records: (1) Supporting records to indicate established schedules and procedures are applied. (2) Maintain individual calibration records indicating calibration data, and results for each item requiring calibration.	
i. Calibration status: (1) Use of labels or other devices to indicate calibration data, due date. (2) Method to indicate the status of those items whose size or characteristics prohibit the application of labels. (3) Method to indicate the applicable condition of items not required to be used to full capability or functional checks only. (4) Monitoring of recall records to assure adherence to calibration schedules.	
j. Control subcontractor calibration: Procedure to assure that subcontractors performing calibration comply with this specification traceable to N.B.S.	
k. Storage and handling: Procedure to assure that subcontractors performing calibration comply with this specification traceable to N.B.S.	
l. Amendment and revision: (1) Method to authorize use of amended standard after contract effective data. (2) Procedure used to provide notification to customers for use of amended standard.	

APPENDIX C SAMPLE MEASUREMENT CAPABILITY PERFORMANCE

C.1 MEASUREMENT CAPABILITY STUDY

A Measurement Capability Study allows a Qualification Team the ability to assess the performance of certain instrumentation within a laboratory. Refer to *IPC-PC-90 General Requirements for Implementation of Statistical Process Control*. Without this knowledge, a Qualification Team cannot make informed decisions as to how much attribute variation is the supplier's and how much is the evaluating measurement system.

C.1.1 MEASUREMENT ERROR

When results are measured, it is important that a measurement system and gaging produce valid data. When data is reported, it is advisable to cite an estimate of accuracy. To some degree, there are errors in all measurement. Since a Qualification Team cannot determine a true value of measurement, it is important that the team try to approximate the best reasonable value that can be deduced from these measurements. To determine the magnitude of such errors, a gage capability study can be performed.

C.2 GAGE CAPABILITY STUDY

In general, a gage capability is the ability of the Qualification Team to look at the accuracy, repeatability, reproducibility, and stability combined in a single value. Three different people have assessed three different averages represented as X_A , X_B , and X_C . To assess the accuracy, one could average X_A , X_B , and X_C and take the difference between the figure and the true value. The capacity is the difference between the extremes encountered over a period of time.

C.2.1 Formal Gage Study

A Formal Gage Study is a more comprehensive gage study that can identify the proportion of variation of both the repeatability and reproducibility. This type of study can be performed using several different operators each performing several different measurement studies.

Figure 3: Variable Gage Study

Part	Inspector A	Inspector B	Inspector (A-B)
1	1	3	2
2	3	4	1
3	6	7	1
4	5	7	2
5	9	8	1
Sum of Ranges:			7

(All numbers in tenths of an inch.)

$$\text{Average Range } (\bar{R}) = \frac{7}{5} = 1.4$$

$$\text{Gage Error} = 4.33 (\bar{R}) = 4.33 * 1.4 = 6.06$$

$$\frac{\text{Gage Error}}{\text{Specifications Tolerance}} = \frac{6.06}{40} = 15.15\%$$

C.2.2 Quick-Look Gage Study

A gage capability study can be performed within a short period of time using two operators, both of whom measure a set of five parts (selected at random) once each time.

The difference between both operators' measurements should be determined, and the average range should be calculated. The gage error is determined by multiplying the average range by 4.33 (for a sample of 5), thus providing the 99% spread of a normal distribution. The gage is considered acceptable if the gage error is less or equal to 20% of the specification tolerance.

Figure 4: Measurement System/Gage Capability

Measurement System/Gage Capability Calculation Worksheet												
Part/Name:				Gage Name:				Part No.:				
Characterstic:				Gage No.:				Measurement Unit:				
Specification:				Gage Type:				Zero Equals:				
Operator: A				B				C				
Sample No.:												
	1st trial	2nd trial	3rd trial	Range	1st trial	2nd trial	3rd trial	Range	1st trial	2nd trial	3rd trial	Range
1												
2												
3												
4												
5												
6												
7												
8												
total												

$\bar{R}_a$

sum
 $\bar{X}_a$

$\bar{R}_b$

sum
 $\bar{X}_b$

$\bar{R}_c$

sum
 $\bar{X}_c$

Test for Control:

Upper Control Limit. $UCL = D_4 \bar{R} = \underline{\hspace{1cm}} \times \underline{\hspace{1cm}} = \underline{\hspace{1cm}}$
 where: $\bar{R}$ is the average of $\bar{R}_a + \bar{R}_b + \bar{R}_c = \underline{\hspace{1cm}} + \underline{\hspace{1cm}} + \underline{\hspace{1cm}} = \underline{\hspace{1cm}} = \underline{\hspace{1cm}}$

If any individual range exceeds this limit, the measurement should be reviewed, repeated, corrected or discarded as appropriate, and new averages should be computed.

Measurement System/Gage Capability Analysis:

Equipment Variation (Repeatability) = $K_1 \bar{R} = \underline{\hspace{1cm}} \times \underline{\hspace{1cm}} = \underline{\hspace{1cm}}$ Repeatability

Operator Variation (Reproducibility) = $K_2 \bar{X}_{ab} = \underline{\hspace{1cm}} \times \underline{\hspace{1cm}} = \underline{\hspace{1cm}}$ Reproducibility

X_{ab} is the difference between the maximum and the minimum

Total Repeatability and reproducibility Variation (R & R) = $\sqrt{(\text{Repeatability})^2 + (\text{Reproducibility})^2}$
 $= \sqrt{(\underline{\hspace{1cm}})^2 + (\underline{\hspace{1cm}})^2} = \sqrt{\underline{\hspace{1cm}} + \underline{\hspace{1cm}}} = \sqrt{\underline{\hspace{1cm}}} = \underline{\hspace{1cm}}$ gage capability

$\frac{\text{Total Gage Capability (R\&R)}}{\text{Specification Tolerance}} = \underline{\hspace{1cm}} = \underline{\hspace{1cm}} \%$

Notes:

Analysis performed by: (date) _____

APPENDIX D REFERENCED DOCUMENTS

D.1 Digital Documents, EL-Class

Document Number	Document Title
EL-00088-00	<i>DEC STD 088-0 Qualification Procedure for All Printed-Wiring Board Suppliers</i>
EL-00176-00	<i>DEC STD 176-0 Printed-Wiring Board Acceptance Criteria</i>
EL-MF088-02	<i>Destructive Testing Procedures and Microsectioning Guidelines for Printed-Wiring Boards (PWBs)</i>

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D.2 Documents External to Digital

Document Number	Document Title
IPC-PC-90	<i>General Requirements for Implementation of Statistical Process Control</i>
MIL-STD-45662A	<i>Military Standard Calibration Systems Requirements</i>

The above documents can be obtained from your local Digital library or by writing to the address below.

Military standards and specifications
Naval Publications and Forms Center
5801 Tabor Avenue
Philadelphia, PA 19120

IPC (Institute of Printed Circuits) Publications
The Institute for Interconnecting and Packaging Electronic Circuits
7380 N. Lincoln Ave.
Lincolnwood, IL 60646
Telephone (708) 677-2850

GLOSSARY

Area Qualification Office: A functional office within the U.S., GIA, and European PWB community responsible for the content of this document, as well as maintaining all documentation and files required by the implementation of this document. The Qualification Office shall serve as a consultant for application, technical service, and training for those groups responsible for implementing the requirements of this document in their respective geographical areas.

calibrate: To standardize a measuring instrument by determining the deviation from a standard, and to ascertain the proper correction factors.

certifying agency: The functional group that consists of designated members of the DEC STD 088-0 Committee. The certifying agency or representative shall audit the inspection or test facility for compliance with this specification, resulting in the facility becoming certified according to this specification.

DEC STD 088 Committee: Committee comprised of cross-functional representatives from Digital. The committee is responsible for the technical content and requirements of DEC STD 088-0.

dimensional test: A test that measures specific PWB features against the design value.

electrical test methods: Test methods that check the electrical integrity of PWBs after final fabrication.

inspection or test facility: Any location or facility that performs inspection or destructive testing as part of DEC STD 088-0.

Master Equipment List: A list of equipment utilized to perform inspection or tests on PWBs.

microsectioning: Destructive Analysis of PWB products using metallographic procedures and optical microscopy.

Qualified Vendor List (QVL): A listing of all suppliers qualified under all subheads of this document to ship product to Digital Stage 1 assembly plants. Listing on the QVL denotes that a supplier has met all the requirements of this document.

supplier: Any supplier, internal or external to Digital, engaged to fabricate PWBs for Digital.

Thermal Stress Test: Refer to DEC STD 176-0 Printed-Wiring Board Acceptance Criteria, Appendix D for specific procedures.

VMI: Visual Mechanical (nondestructive testing) Inspection performed to ensure critical acceptance criteria specified in DEC STD 176 are met.

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